Looking west from monitoring well MMW014 toward main haul road and Henry Mine Waste Rock Dump MWD090

P4 PRODUCTION

SUPPLEMENTAL MINE WASTE ROCK DUMP AND FACILITY SOIL AND VEGETATION CHARACTERIZATION

SAMPLING AND ANALYSIS PLAN

FINAL
Revision 3

Prepared by

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

August 2009

SUPPLEMENTAL MINE WASTE ROCK DUMP AND FACILITY SOIL AND VEGETATION CHARACTERIZATION

SAMPLING AND ANALYSIS PLAN

Revision 3

June 8, 2009

Submitted as final August 18, 2009

This page was intentionally left blank.

TABLE OF CONTENTS

LIST OF TABLES (attached at end of text)

LIST OF FIGURES (attached at end of text)

ATTACHMENTS

This page was intentionally left blank.

1.0 INTRODUCTION

This document presents the relevant component documents for a stand-alone Sampling and Analysis Plan (SAP) for the Supplemental Waste Rock Dump and Facility Soil and Vegetation Characterization program. The sampling program presented in this SAP was specifically requested by the Agencies and Tribes (A/T) as a comment on the initial plan (Revision 0) that was an addendum to existing 2004 work plans (MWH, 2008). The A/T comments with associated P4 Production L.L.C. (P4) responses and the A/T approval letter of the comment responses are included as Appendix A. The A/T identified data gaps that need to be filled to satisfy objectives of the site investigation (SI). It was indicated that additional sampling of soil and vegetation at all potential source areas should be conducted. Generally, the A/T concluded that upland soil and vegetation are among the primary risk drivers at the site, and that prior data were not sufficient to address the data gap, in part because they have not been shown to be consistent with current data quality protocols and COPCs.

The components of this SAP include the Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and for this project, an updated Health and Safety Plan (HSP). These plans are being submitted as deliverables for work under the Consent Order/Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117. The FSP, QAPP, and HSP are included as Attachments 1, 2, and 3, respectively. In addition, as it is a key part of the project planning process, the Data Quality Objectives (DQOs) are presented in this document in Section 2 and Tables 1 and 2.

While the SAP components are prepared as stand-alone documents, it needs to be recognized that this characterization is part of the overall characterization of the P4 mines (Ballard, Henry, and Enoch Valley; the Site). Therefore the larger workplan and SAP components are not repeated herein (i.e., an abbreviated SAP is presented). For complete background on the overall characterization of the Site the following workplan documents should be referenced:

- Comprehensive Site Investigation Ballard Mine Workplan—Final (MWH, 2004a)
- Comprehensive Site Investigation Henry Mine Workplan—Final (MWH, 2004a)
- Comprehensive Site Investigation Enoch Valley Mine Workplan—Final (MWH, 2004a)
- Comprehensive Site Investigation Ballard Mine Project Field Sampling Plan—Final (MWH, 2004b)
- Comprehensive Site Investigation Henry Mine Project Field Sampling Plan—Final (MWH, 2004b)

- Comprehensive Site Investigation Enoch Valley Mine Project Field Sampling Plan—Final (MWH, 2004b)

- Comprehensive Site Investigation Program Field Sampling Plan—Final (MWH, 2004e)

- Comprehensive Site Investigation Program Quality Assurance Plan—Final (MWH, 2004c)

- Comprehensive Site Investigation Health and Safety Plan—Final (MWH, 2004d)

For the Supplemental Waste Rock Dump and Facility Soil and Vegetation Characterization, a new supplemental FSP, QAPP, and HSP have been prepared to incorporate refined approaches; primarily characterization and quality assurance (QA) approaches. The approaches and changes have been formulated by P4 and the A/T as the planning team members, decision makers, and primary data users. In addition, opposed to amending existing SAP documents, the presentation of complete, supplemental FSP, QAPP, and HSP documents provide for a more efficient review of the planned project, and will provide coherent documents for use by the team members during sampling and analysis.

2.0 DATA QUALITY OBJECTIVES

The DQOs discussed in this section were used to guide the development of the components of this SAP (FSP and QAPP). They identify the quantity and quality of data that must be obtained to complete soil and vegetation characterization and to support the decision making process whether it be related to Engineering Evaluation/Cost Analysis (EE/CA) or Remedial Investigation/Feasibility Study (RI/FS) programs.

2.1 DQO PRESENTATION

The DQOs are consistent with US EPA guidance (EPA, 2006a) and apply the following seven-step process:

1. State the problem
2. Identify the goals of the study
3. Identify information inputs
4. Define the boundaries of the study
5. Develop the analytic approach
6. Specify performance or acceptance criteria
7. Develop the plan for obtaining data

DQOs have been developed for both the potential source areas and background areas. Within these, the principal study questions (from Step 2) have corresponding statements, as appropriate, in each of the remaining DQO steps. Outputs are given in each step and follow the 2006 DQO guidance (EPA, 2006a). The DQOs incorporate the example provided by the A/T and comments on the draft DQOs submitted by P4 (MWH, 2008b). The G9 guidance (EPA, 2006b) and ProUCL 4.0 will be used to select the statistical tools that will be used for data evaluation.

Each step of the DQO Process defines criteria that will be used to establish the final data collection design. The first five steps are primarily focused on identifying qualitative criteria, such as:

- the nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated;
- the decisions or estimates that need to be made and the order of priority for resolving them;
- the type of data needed; and
- an analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings (EPA, 2006a).

The sixth step establishes acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data. For this characterization project, the data are primarily collected for the estimation of COPC levels for individual source areas, and as such, the uncertainty in the data will be estimated and evaluated once collected.

Current EPA-approved methods will be used for estimation of central tendency of the data and level of uncertainty associated with the data. However, for the list of inorganic COPCs to be evaluated, the distribution of the data is undefined at this time and may vary on a COPC basis. Therefore, statistical procedures and acceptable levels of uncertainty will not be evaluated until the data are reported and validated. Because of the temporal boundaries of the data collection activity, any additional sampling to reduce statistical uncertainty would need to be conducted during a similar season, unless the data indicate that the early summer and fall data are statistically indifferent. This will be an important consideration when evaluating the level of acceptable uncertainty, as an additional effort could cause delay in the overall program. At this time, a reasonable level of sampling effort per potential source area has been developed based on A/T input, ProUCL 4.0 guidance, and P4 (MWH) input.

In the seventh step of the DQO Process, a data collection design is developed that will generate data meeting the quantitative and qualitative criteria specified at the end of Step 6. The output from this step is largely contained in the FSP.

2.2 SUPPORTING INFORMATION

Two key factors that need to be considered in the DQO process are the conceptual model, for helping formulate the problem statements (DQO Step 1), and in this case, the facility maps for identifying the spatial bounds of the program. These are presented here to support the DQOs detailed in Tables 1 and 2. Further information supporting the sample type, size and distribution is also present in this section. In addition, further information related to the radiological assessment is included.

2.2.1 Conceptual Model

The primary components of the conceptual model that support the DQOs are summarized as follows:

Soil

- Source –contaminants of potential concern (COPC) present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities

- Release mechanisms – direct exposure to the COPC concentrations, or fragmentation of interburden and overburden rocks; exposure to air and water results in mobilization of COPC from increased surface area; precipitation may leach and mobilize COPC primarily during spring runoff

- Exposure pathways – primary exposure through ingestion or inhalation of COPC or dermal exposure to COPC in the soil on the surface of waste rock dumps or other facilities. Secondary exposure through uptake by plants and consumption of the plant material (see vegetation below).

- Receptors – livestock and wildlife ingestion of soil with COPC levels or contaminated vegetation during feeding; human ingestion or dust inhalation

Vegetation

- Source –COPC present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities
- Release mechanisms – COPC uptake is direct from soil, or COPC becomes available for plant uptake through fragmentation of interburden and overburden rocks and exposure to air and water results in mobilization of COPCs
- Exposure pathways – uptake of COPC by vegetation from soil and water then the subsequent ingestion of contaminated vegetation; levels of COPC uptake may vary by plant species and soil concentrations
- Receptors –birds, livestock, small mammals, and elk ingesting contaminated plant material, and humans through ingestion of either plants (attractive wild edibles) or affected animals

These conceptual model components will be re-evaluated, refined, and verified as the project moves into risk assessment. The primary objective of the study presented in this SAP is the characterization of the nature and extent of COPC within the study boundaries. This data will then be available to help facilitate the determination of risk to human health and ecological receptors.

2.2.2 Facility Maps

Facility maps for Ballard, Henry, and Enoch Valley Mines are provided in support of the DQOs (Figures 1 through 3, respectively). Because the mines are mostly inactive and have been reclaimed, and processing was done off-site, the ancillary facilities at the mines are relatively few. (Cross-mine traffic and ore load-out facilities are still in use at Enoch Valley Mine; reclamation for these limited areas at Enoch Valley Mine will be conducted under the Enoch Valley Mine reclamation plan when ore transport is complete.) The mine areas are dominated by waste rock dumps, backfilled mine pits, and a few unfilled or partially backfilled mine pits.

2.2.3 Discussion of Sampling Program Rationale

The size of the composite sample areas (a 50 by 50 foot quadrat) incorporates the smallest home range of the potential target receptors (a small mammal species). Therefore it is unnecessary to reduce action levels (or laboratory detection limits) in proportion to the number of samples forming the composite.

The use of five samples in each composite is consistent with the EPA Soil Screening Guidance: Technical Background Document (EPA, 1996), which recommends 4 to 5 samples from quadrats up to 100 by 100 feet. In addition, EPA Guidance for Quality Assurance Project Plans (EPA, 2002) allows for consideration of practical issues associated with sample handling and homogenization. The use of five subsamples allows for obtaining enough sample mass for the laboratory, but not so much as to burden the laboratory with excess material or require splitting in the field. (Additional grid locations may be sampled to meet laboratory requirements.)

The use of 10 composite samples to characterize the individual waste rock dump areas is in part professional judgment (as well as being consistent with minimum sample number recommendations in ProUCL 4.0). Factors that have been considered include: knowledge of the geology of the waste, and of the waste rock disposal and reclamation practices. In addition, knowledge of previous sampling results has also played into this judgment. Although, the A/T, at this time, have not supported the use of the pre-2004 data for scoping of the soil and vegetation sampling plan pending further assessment of the data quality, it is not possible to ignore what is known of those data and what the expected result of the current program will be based on the previous data. These expectations are: (1) the variability between composite samples for individual waste rock dumps will be acceptable given the absolute concentrations; (2) decisions associated with risk-based screening levels will generally be unambiguous for key parameters; and (3) the data will be primarily used to rank the relative risk of the individual units and provide important information for ranking the relative priority of remedial actions, if required.

Given what is known about the character of the waste rock dumps, the conceptual models, and constraints due to the large, yet relatively uniform, areas to be sampled, the minimum number of samples per unit needed to conduct a statistically meaningful analysis, as indicated in ProUCL 4.0, appears appropriate as indicated in the current DQOs. However, unexpected results, high variability or conditions encountered during the survey of the waste rock dumps may indicate the need for additional sampling. This eventuality is not excluded by the current plan.

The sampling plan also addresses potential seasonal variability in the vegetation, in particular, the A/T have identified that potential increases in selenium content in forbs (alfalfa in particular) through the growing season is a concern. The A/T's concern is in large part due to research conducted at a phosphate mining site in southeast Idaho (Mackowiak and Amacher, 2005). This research found that selenium concentrations in alfalfa increased from the spring to fall, while concentrations tended to decrease in other plant life forms. A subset of spring sampling locations will be selected for sampling by life form (grasses, forbs, and woody vegetation). At these locations a fall sampling event will be conducted of the forbs.

2.2.4 Radiological Assessment Approach

The RESRAD V6.4 computer code is used to perform a preliminary investigation to assess if radium-226 levels at the site indicated potential risk based on samples. This assessment can be made based on uranium concentrations in soil. The RESRAD code is used for estimating the carcinogenic risk to human receptors from exposure to radionuclides in soil or soil-like media. RESRAD has been used widely by the U.S. Department of Energy (DOE), its operations and area offices, and its contractors for deriving limits for radionuclides in soil. RESRAD has also been used by the U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers, U.S. Nuclear Regulatory Commission (NRC), industrial firms, universities, and foreign government agencies and institutions. Radium-226 is included as a principal radionuclide in the RESRAD database. The RESRAD model will generate acceptable estimates of radium-226 and related uranium daughter products over time.

The RESRAD model to be developed for the waste-rock sites will include radium-226 values from uranium data collected during the 2009 field season. In risk assessment, if screening results from the model produce estimates that indicate a potential risk, further characterization may be required including potentially collecting specific radium-226 data. The soil samples will be used to determine if the radium-226 levels exceed EPA soil screening levels (SSL). The SSL's for radium-226 will be determined from the current EPA standard for ingestion and particulate inhalation. Some key reference for the RESRAD program and its use are: ANL (2001), Gilbert et al. (1983); and Yu et al. (1993 and 1994).

3.0 CONCLUSIONS

The DQOs presented herein in Tables 1 and 2 are used in developing the sampling and analysis approaches presented in the attached FSP and QAPP. While these documents are intended as stand-alone documents, this is a supplemental program associated with the overall Site Investigation. The initial result of this supplemental program will be a technical memorandum transmitting the data; however, complete evaluation of the data will be included in the overall SI Report and included in the risk assessment with other soil and vegetation data, and data from other media such as surface water and groundwater.

4.0 REFERENCES

Argonne National Laboratory (ANL) 2001. *User's Manual for RESRAD Version 6, ANL/EAD-4,* Environmental Assessment Division, Argonne, Illinois, July.

EPA, 1996. *Soil Screening Guidance: Technical Background Document.* U.S. Environmental Protection Agency, Washington DC, EPA/540/R95/128, OSWER 9355.4-17A, May 1996.

EPA, 2001. *Guidance on Characterizing Background Chemicals in Soils at Superfund Sites.* External Review Draft, U.S. Environmental Protection Agency, Washington DC, EPA 540-R-01-003, OSWER 9285.7-41, June 2001.

EPA, 2002. *Guidance for Quality Assurance Project Plans, EPA QA/G-5.* U.S. Environmental Protection Agency, Washington DC, EPA/240/R-02/009, December 2002.

EPA, 2006a. *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4.* U.S. Environmental Protection Agency, Washington DC, EPA/240/B-06/001, February 2006.

EPA, 2006b. *Data Quality Assessment: Statistical Procedures for Practitioners, EPA QA/G-9S.* U.S. Environmental Protection Agency, Washington DC, EPA/240/B-06/003, February 2006.

Gilbert, T.L. et al., 1983. *Pathways Analysis and Radiation Dose Estimates for Radioactive Residues at Formerly Utilized MED/AEC Sites, ORO-832 (Rev.).* Prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Department of Energy, Oak Ridge Operations, Oak Ridge, Tenn., March (reprinted with corrections Jan. 1984).

IDEQ, 2008. *Technical Memorandum Chemicals of Potential Concern to Sample for Soil and Vegetation at Ballard, Henry, and Enoch Valley Mines.* Attached to the September 16, 2008 letter from Mine Rowe (IDEQ) transmitting comments on the June 26, 2008 Supplemental Waste Rock Dump Soil and Vegetation Characterization Planning Memorandum.

Mackowiak, C.L. and Michael C Amacher, M.C., 2005. *Seasonal Plant Uptake of Selenium at Wooley Valley Unit 4 Lift 1 Lower Slope Waste Rock Dump.* Draft July 27, 2005 document.

MWH, 2004a. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program.* Prepared for P4 Production. March.

MWH, 2004b. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program.* Prepared for P4 Production. April.

MWH, 2004c. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Quality Assurance Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2004d. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Health and Safety Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2004e. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Program Field Sampling Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. April.

MWH, 2008. *Supplemental Waste Rock Dump Soil and Vegetation Characterization Planning Memorandum – Draft Revision 0*. Prepared for P4 Production, June 26, 2008.

Yu, C. et al., 1993. *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil*. ANL/EAIS-8, Argonne National Laboratory, Argonne, Ill., Apr.

Yu, C. et al., 1994. *RESRAD BUILD: A Computer-Model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material, ANL/EAD/LD-3*. Argonne National Laboratory, Argonne, Ill.

This page was intentionally left blank.

Table 1: Source Area DQOs

Step 1 - State the Problem	Enriched concentrations in geologic material, and oxidation, leaching, and mobilization of elements in waste rock can result in the release of elevated concentrations of COPCs into the environment. Additional detail relating to the conceptual model is presented in Section 2. Existing data do not include all relevant COPCs that have human health and ecological risk-based screening levels, and in some cases additional spatial coverage is required. Nature and extent of contamination in surface soil and vegetation needs to be characterized sufficiently to allow for risk assessment (RA) and feasibility studies (FS) to be conducted. Source areas may need to be prioritized for any necessary remedial action. Planning team, decision makers, and principal data users include P4 and the A/T.
Step 2 – Identify the Goals of the Study	<u>Principal Study Question 1 (PSQ1):</u> Are sufficient soil and vegetation COPC concentration data available to characterize nature and extent <u>and seasonal variability</u> in source areas and receptor pathways so that initial screening, RA, and FS analyses can be completed? <u>Alternative actions:</u> 1. No action. Existing data are of adequate quality and quantity to characterize source areas. 2. Collect soil and vegetation data to provide additional COPC data and spatial coverage. <u>Decision/estimation statement:</u> Decide whether sufficient data (number of COPC, and spatial and temporal coverage) are available to adequately characterize the nature and extent of soil and vegetation contamination at potential source areas. <u>Principal Study Question 2 (PSQ2):</u> Are data sufficient to determine if risk-based screening levels for human health and ecological receptors are exceeded for specific source areas? <u>Alternative actions:</u> 1. No action. COPC concentrations in soil and vegetation are sufficient and screening indicates that COPCs are below risk-based screening levels. 2. Some COPC concentrations exceed risk-based screening levels; carry all COPCs into RA and conduct formal screening level risk assessments (SLRA - ecological and human health) and baseline risk assessment (BRA), as needed<u> in accordance with the pending RA work plan and EPA guidance.</u> <u>Decision/estimation statement:</u> Decide what additional soil and vegetation data are needed to adequately characterize the nature and extent of soil and vegetation contamination at potential source areas so that comparisons can be made to appropriate screening levels; collect data, as needed.

	Principal Study Question 3 (PSQ3): Are sufficient soil and vegetation type and coverage data available to support analyses in RA and FS (for example, are culturally significant plants present in the source areas that could result in human health risk if consumed, are selenium accumulating plants present, or are species inappropriate for potential remedial actions selected)? Alternative actions: 1. No action. Existing data are of adequate quality and coverage to characterize source areas. 2. Collect additional soil and vegetation type data to provide supporting data for RA and FS analyses. Decision/estimation statement: Decide whether sufficient species and coverage data are available to adequately characterize source areas sufficiently to support RA and FS studies and collect additional data, as needed.
Step 3 – Identify Information Inputs	The information inputs for the decision process includes the following items that may already exist or will need to be collected: – • list of COPCs (IDEQ, 2008) *Radium-226 will be evaluated using uranium concentrations and the RESRAD program (ANL, 2001: Gilbert, et al., 1983; Yu, et al., 1993; Yu, et al.,, 1994). If risk is indicated there may be the need for further assessment of radium-226 (further discussion of the RESRAD program is included in Section 2).* • existing and refined conceptual site models • existing facilities investigation information to be updated as needed (inventory and spatial delineation of potential source areas; current facilities maps are provided as Figures 1 through 3) • developed sample location maps (contained in FSP) • new data for soil and vegetation COPC data (use of existing data will be dependent upon evaluations of data usability); data will be analyzed with appropriate methods for determining inorganic concentrations with detection limits suitable for comparison to risk-based screening levels • existing data on type and abundance of soil and vegetative covers • existing and new data on the type, abundance, and relative distribution of hyper-accumulators and culturally significant vegetation • new data on the seasonal variability of COPC uptake in vegetation • risk-based screening benchmarks for COPCs

Step 4 – Define the Boundaries of the Study	Spatial boundaries: Spatial delineation of all potential source areas at Ballard, Henry, and Enoch Valley Mine areas, including: • waste rock dumps including mass wasting areas (out-of-pit and in-pit backfill); • miscellaneous fills (none known); • inactive haul roads; • open pits; and • inactive stockpiles. The potential sources areas will range in size as determined by a combination of analytical and/or observational information. Sampling and decision units will be individual facilities. Vertical boundary: Soil - Maximum depth will be 6 inches below the ground surface Vegetation - Edible above ground vegetative growth. Temporal boundary: Soil and vegetation sample collection is planned for between June 15 and July 15 for a full range of plant life forms and sites and between August 17 and September 15 2009 for a subset of locations for forbs only to observe any potential seasonal variability. Surveys of soil and vegetative cover and culturally significant plants will be conducted in late May—mid-June to facilitate easier species identification. All historic soil and vegetation data will be evaluated for quantity, quality, and coverage, including reclamation records and observations. It is assumed that soil quality will not change during the time frame of the study. Practical constraints: Bedrock preventing soil sampling to 6 inch depth. Access limitations to sampling sites (e.g., highwalls, or surface water features). Lack of vegetation or soil in certain source areas (e.g., haul roads, stockpiles, and open pits).

Step 5 – Develop the Analytic Approach	If available data (existing and newly collected) are not suitable to characterize nature and extent (lack sufficient COPCs), and do not provide a reliable estimate of potential source area concentrations, then additional data will be collected. Otherwise the data will be considered adequate for characterization. (PSQ1) Ten composite samples will be used to characterize individual source areas if the area is of sufficient size to contain a random distribution of 10, 50 X 50 foot quadrats. For smaller areas, <u>five judgmental</u> discrete samples will be collected from the area for initial screening (see Step 7). This sample size is largely judgmental, but is based on input from the data users (A/T and P4) and is consistent with statistical guidance (ProUCL 4.0). Population parameters will include min, mean, max, 95% UCL, ProUCL analysis, and EPA QA/G-9S guidance (EPA, 2006b) methods, as appropriate for the data distribution. Initially, it is expected that the individual samples will be screened against risk-based screening levels, then if elevated levels are indicated the 95% UCL of the data for individual source areas will also be evaluated. However, this will be subjected to the statistical evaluation of the data to determine the appropriate measures of central tendency and uncertainty. If the estimated COPC concentrations exceed risk-based screening levels, then it will be carried forward for risk assessment. Otherwise the COPC will be dropped (note that evaluation of cumulative risk may require consideration of COPCs that have been screened out for discrete assessment). <u>Screening will take place in the appropriate step of the RA in accordance with the pending RA work plan and EPA guidance</u>. (PSQ2) Additional delineation of culturally significant plants will be conducted, and if culturally significant plants or specific species of special concern are present, then additional targeted sampling will be conducted based on evaluation of specific risk considerations. Otherwise there will be no further action. (PSQ3)
Step 6 – Specify Performance or Acceptance Criteria	Ten composite samples will be obtained per source area for statistical analysis (unless otherwise planned in the FSP). Per ProUCL 4.0, the minimum sample size for background characterization is, ideally, 8 to 10; the minimum sample size for hypothesis testing is, ideally, 10 to 15. The primary statistic of interest is the true mean individual contaminant concentration for soil and vegetation in each source area. However, the determination of the "true mean" would require the collection and analysis of a prohibitive number of samples (a virtual 100% census of the area by definition). Therefore, the maximum contaminant concentration, or "Max Test" will be used. The maximum contaminant concentration from composite samples is a conservative estimate of the true mean (EPA 1996; Soil Screening Guidance: User's Guide. OSWER 9355.4-23). If this maximum contaminant concentration value exceeds risk-based screening levels, then the 95% UCLs will be estimated and used to address uncertainty in the comparison. If the 95% UCL value is greater than the maximum contaminant concentration, then the 95% UCL value may be used to characterize the contamination for the source area. Soil Screening Levels (SSLs) will use generic risk-based levels identified by EPA (See Table 1-2 of the QAPP). Background levels may be used in place of the generic SSLs if background levels are higher than the generic SSLs. The precision, accuracy, representativeness, comparability, and completeness

	criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about the nature and extent of soil and vegetation contamination at potential source areas from mine related activities. All data must meet approved usability as defined in the QAPP. Specific details of the sampling design are set forth in the plan presented herein using considerations documented.
Step 7 – Develop the Plan for Obtaining Data	PSQ 1 Plan - Conduct evaluation of available data and/or applicable site data to determine if it adequately characterizes the nature and extent of soil and vegetative contamination at all potential source areas and for all relevant COPCs. Due to lack of COPC coverage and other readily apparent concerns, it can be concluded that this evaluation is sufficiently complete and that additional characterization is required. PSQ 2 Plan – To support initial screening, RA, and FS evaluations, additional sampling is required to characterize the nature and extent of soil and vegetation contamination at source areas. Ten composite samples will be used to characterize individual source areas if the area is sufficiently large enough to contain a random distribution of ten, 50 X 50 foot quadrats. A maximum of ten, 1-ft2 sample grid locations, within each of the ten quadrats will be visited to obtain the composited sample. For areas less than 10 acres and currently active areas five judgmental grab samples will be collected. These samples will be selected to be representative of the relative abundance of plant species and soil variability in the area. If the area is sufficiently large, then five 2,500 sq. ft. quadrats will be used to collect composite samples. The quadrats will still be located on a judgmental basis. These samples will be considered reconnaissance level for initial screening. <u>To address seasonal variability in forbs, P4 will sample soil and vegetation at all the selected quadrats plus the additional sites related to the mine facilities during the early summer sampling event. At ten sites per mine, vegetation will be separated as to life form (grasses, forbs, woody species). The quadrats for which vegetation will be separated by life form will be selected from the total number of sample sites already determined (i.e., these would not be additional sites). For the fall sampling, forbs will be collected at the same ten quadrats per mine selected in the early summer for life form sampling.</u> Specific details of the sampling design are set forth in the SAP including quality assurance and quality control procedures to help ensure defensible results. These details are presented herein with considerations and key assumptions documented. The resulting data will be evaluated to determine if it is sufficient to conduct a screening of COPCs against risk-based screening levels, then an initial screening will be conducted. PSQ 3 Plan – Conduct soil and vegetation survey to obtain the type and distribution of plant species, and soils and cover materials. The survey will be conducted on a relative percent coverage basis, but areas of culturally significant species will be specifically identified and mapped. In addition, salt licks or similar areas, where soil consumption by wildlife may be an additional concern to be considered during risk assessment, will be noted.

Table 2: Background DQOs

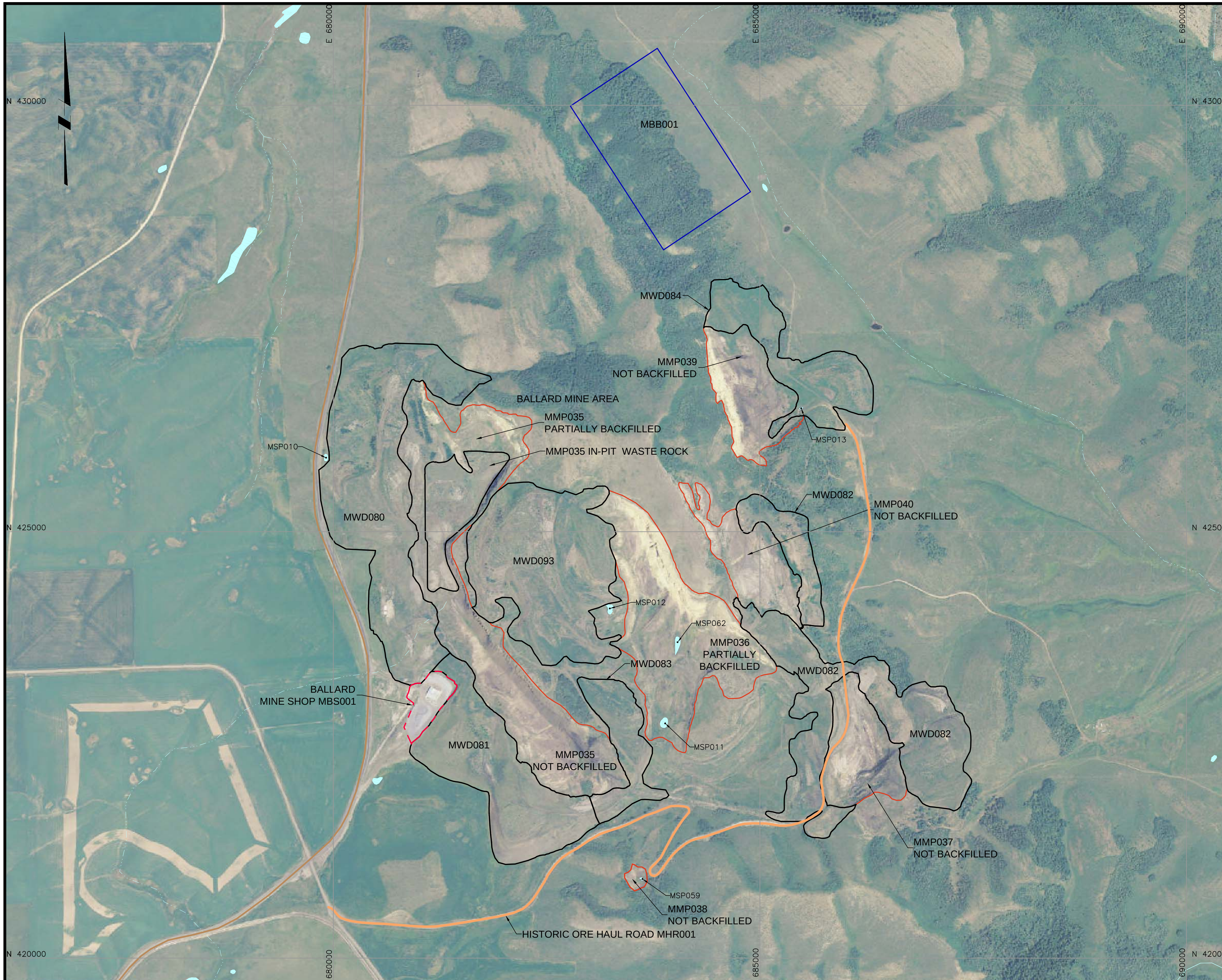
Step 1 - State the Problem	Most Site related COPCs are present in the environment at some concentration. The existing background data set may not be of adequate coverage or representativeness to estimate the background COPC concentrations or allow comparisons with site data. Such data will be required for RA.
Step 2 – Identify the Goals of the Study	Principal Study Question (PSQ): 1. What are representative background soil and vegetation COPC concentrations in locations representative of the mine footprint? Alternative actions: 1. No action. Existing data adequately represent background soil and vegetation COPCs. 2. Collect additional soil and vegetation data because historic background data are insufficient. Decision/estimation statements: 1. Decide whether sufficient soil and/or vegetation background data for the relevant COPCs are available to adequately characterize background conditions. 2. Decide what additional soil and vegetation data are needed to adequately characterize conditions.
Step 3 – Identify Information Inputs	• list of COPCs (IDEQ, 2008) • existing and refined conceptual site model • existing site geologic and facilities maps • new survey of proposed background areas, for mine-related disturbances • type, abundance, and distribution of hyper-accumulators and culturally significant vegetation • new data on the seasonal variability of COPC uptake in vegetation • existing sample location maps (included in FSP) • soil and vegetation analytical data (new and existing)
Step 4 – Define the Boundaries of the Study	Spatial boundary: Undisturbed areas, away from potential sources, representative of background conditions for Ballard, Henry, and Enoch Valley mines. Selected areas should be typical of the soil profile in place prior to disturbance where mine waste would be placed. The surface area is selected to be representative of a typical waste rock dump footprint so the sample coverage is similar and characteristic of an area that could be covered by waste rock disposal. The background areas will range in size as determined by a combination of analytical and/or observational information. A maximum of 10 samples will be collected from each sample location.

	<u>Vertical boundary:</u> Soil - Maximum depth will be 6 inches below the ground surface unless bedrock or access/logistical constraints prevent sampling to this depth. Vegetation - Edible above ground vegetative growth. <u>Temporal boundary:</u> <u>Soil and vegetation sample collection is planned for between June 15 and July 15 for a full range of plant life forms and sites and between August 17 and September 15 2009 for a subset of locations for forbs only to observe any potential seasonal variability.</u> Surveys of soil and vegetative cover and culturally significant plants will be conducted in late-May to mid-June. All historic representative background soil and vegetation data of adequate quantity, quality, and coverage may be used to characterize background. <u>Practical constraints:</u> Bedrock preventing soil sampling to 6 inch depth. Mining-related disturbances. Access limitations to sampling sites (e.g., surface water features). Lack of vegetation.
Step 5 – Develop the Analytic Approach	If sufficient data points (existing and newly collected) that meet data validation requirements are available to provide a reasonable characterization of background, then no further data collection is required to calculate meaningful background. Otherwise the data will be considered adequate for characterization. Ten composite samples will be used to characterize individual source areas if the area is of sufficient size to contain a random distribution of 10, 50 X 50 foot quadrats. Population parameters will include min, mean, max, 95% UCL, ProUCL 4.0 analysis, and EPA QA/G-9S guidance (EPA, 2006b) methods as appropriate for the data distribution. Data will be utilized in the risk assessment consistent with EPA (2001) and procedures identified in ProUCL 4.0.
Step 6 – Specify Performance or Acceptance Criteria	Representative concentrations for background may be determined through statistical analysis depending on the number of samples and variability in the set or based on the maximum detected background concentration, per applicable ProUCL 4.0 or G9 guidance (EPA, 2001 & EPA, 2006b). The precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in assessing background concentrations. All data must meet approved usability as defined in the QAPP.
Step 7 – Develop the Plan for Obtaining Data	Conduct an evaluation of available data to determine which data are suitable for characterizing background conditions. Conduct additional sampling to complete characterization of background conditions, as necessary. Specific details of the sampling design are set forth in the SAP including quality assurance and quality control procedures to provide defensible results. These details are presented herein with

	considerations and key assumptions documented. Calculate representative background concentrations for soil and vegetation COPCs. Background data will be assessed along with data on COPC concentration in source areas in the ecological and human health risk assessments. During the early summer sampling event, at ten total background sites vegetation will be separated and sampled as to life form (grasses, forbs, and woody species). Three quadrats in each of the three background areas will be randomly selected and the tenth quadrat will be randomly selected from a pool of the remaining quadrats. For the fall sampling, forbs will be collected at the same ten background sites selected in the early summer consistent with the procedures of the source area sampling.

This page was intentionally left blank.

This page was intentionally left blank.



LEGEND:

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUE FOR INTERNAL REVIEW	CF	CD	04/09
A	ISSUE FOR INTERNAL REVIEW	DDW	CD	01/09

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES, AND KNOW HOW OF MWH AS AUTHOR, ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. PRE-MINE TOPOGRAPHY GENERATED FROM USGS DIGITAL ELEVATION MODELS (DEM)-24K AND DIGITAL LINE GRAPHS (DLG) FOR HENRY, ID; WAYAN WEST, ID; CHINA HAT, ID; JOHNSON CREEK, ID; SODA SPRINGS, ID; WAYAN EAST, ID; UPPER VALLEY, ID; DRY VALLEY, ID AND LOWER VALLEY, ID. ORIGINAL DATA LOCATED: USSBS1S01\CAD_ENGINEERING_SUPPORT\DESIGN-DRAFTING \CLIENTS_I-P\MONSANTO-P4 PRODUCTION \1010076-2008 HGDR REVA\003-SURVEY DATA\USGS
2. PRE-MINE TOPOGRAPHY PROJECTION IS IDAHO EAST STATE PLANE COORDINATES, NAD 27.

DESIGNED BY	C. DUFFY	04/14/09
DRAWN BY	D. WILLIAMS	04/14/09
CHECKED BY	C. DUFFY	04/14/09
APPROVED BY	C. FOULK	04/14/09
PROJECT MANAGER	C. FOULK	04/14/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 PRODUCTION
SITE INVESTIGATION

PROJECT LOCATION
BALLARD, HENRY, AND ENOCH VALLEY MINES

PROJECT
2009 SOIL AND VEGETATION CHARACTERIZATION

TITLE
BALLARD MINE FACILITIES

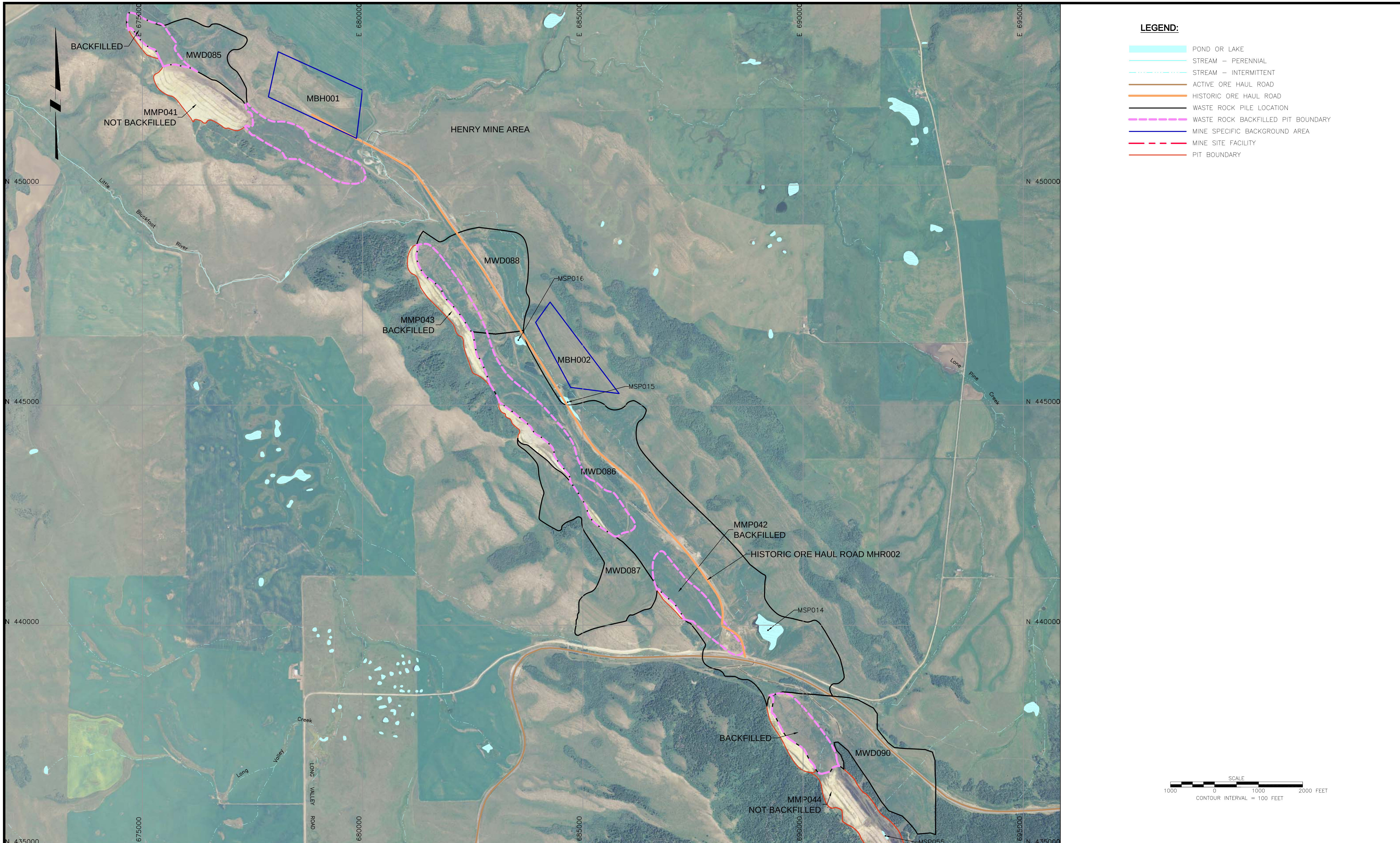
MWH

FIGURE 1

REVISION
B

FILE NAME
1005813D059

N:\Design-Drafting\Clients_I-P\Monsanto-P4 Production\1005813 2009 Soil and Vegetation Characterization\013-Sheet Set\1005813D059



B	ISSUE FOR INTERNAL REVIEW	CF	CD	04/09
A	ISSUE FOR INTERNAL REVIEW	DDW	CD	01/09
ISSUE/REV	DESCRIPTION	TECH	ENG	DATE

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES, AND KNOW HOW OF MWH AS AUTHOR, ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. PRE-MINE TOPOGRAPHY GENERATED FROM USGS DIGITAL ELEVATION MODELS (DEM)-24K AND DIGITAL LINE GRAPHS (DLG) FOR HENRY, ID; WAYAN WEST, ID; CHINA HAT, ID; JOHNSON CREEK, ID; SODA SPRINGS, ID; WAYAN EAST, ID; UPPER VALLEY, ID; DRY VALLEY, ID AND LOWER VALLEY, ID. ORIGINAL DATA LOCATED: USSBS1S01\CAD_ENGINEERING_SUPPORT\DESIGN-DRAFTING \CLIENTS_I-P\MONSANTO-P4 PRODUCTION \1010076-2008 HGDR REVA\003-SURVEY DATA\USGS
2. PRE-MINE TOPOGRAPHY PROJECTION IS IDAHO EAST STATE PLANE COORDINATES, NAD 27.

DESIGNED BY	C. DUFFY	04/14/09
DRAWN BY	D. WILLIAMS	04/14/09
CHECKED BY	C. DUFFY	04/14/09
APPROVED BY	C. FOULK	04/14/09
PROJECT MANAGER	C. FOULK	04/14/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 PRODUCTION
SITE INVESTIGATION

PROJECT LOCATION
BALLARD, HENRY, AND ENOCH VALLEY MINES

PROJECT
2009 SOIL AND VEGETATION CHARACTERIZATION

TITLE
HENRY MINE FACILITIES

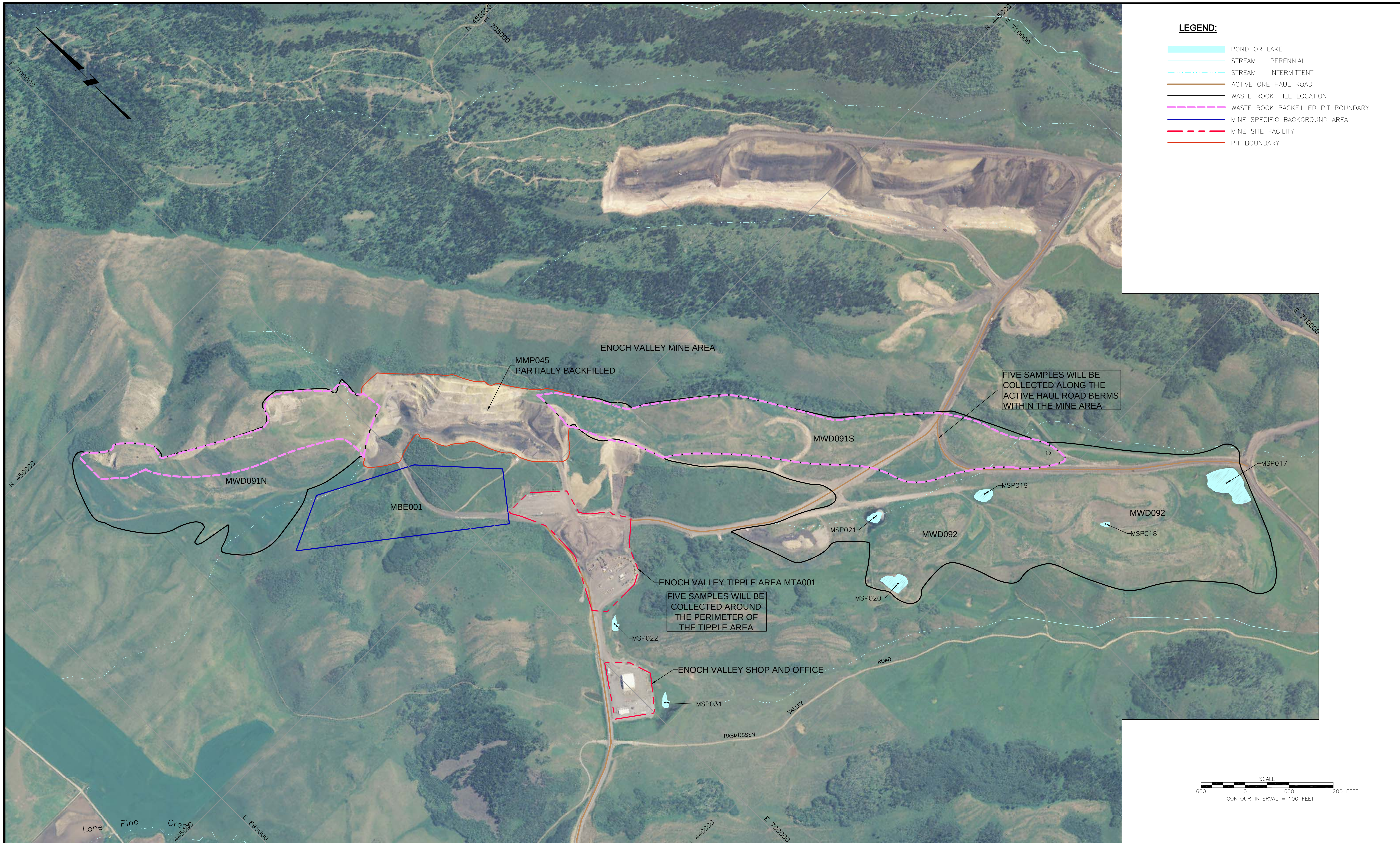
MWH

FIGURE 2

REVISION B

FILE NAME 1005813D060

N:\Design-Drafting\Clients_I-P\Monsanto-P4 Production\1005813 2009 Soil and Vegetation Characterization\013-Sheet Set\1005813D060



ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUE FOR INTERNAL REVIEW	CF	CD	04/09
A	ISSUE FOR INTERNAL REVIEW	DDW	CD	01/09

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES, AND KNOW HOW OF MWH AS AUTHOR, ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
1. PRE-MINE TOPOGRAPHY GENERATED FROM USGS DIGITAL ELEVATION MODELS (DEM)-24K AND DIGITAL LINE GRAPHS (DLG) FOR HENRY, ID; WAYAN WEST, ID; CHINA HAT, ID; JOHNSON CREEK, ID; SODA SPRINGS, ID; WAYAN EAST, ID; UPPER VALLEY, ID; DRY VALLEY, ID AND LOWER VALLEY, ID. ORIGINAL DATA LOCATED: USSBS1S01\CAD_ENGINEERING_SUPPORT\DESIGN-DRAFTING \CLIENTS_I-P\MONSANTO-P4 PRODUCTION \1010076-2008 HGDR REVA\003-SURVEY DATA\USGS
2. PRE-MINE TOPOGRAPHY PROJECTION IS IDAHO EAST STATE PLANE COORDINATES, NAD 27.

DESIGNED BY	C. DUFFY	04/14/09
DRAWN BY	D. WILLIAMS	04/14/09
CHECKED BY	C. DUFFY	04/14/09
APPROVED BY	C. FOULK	04/14/09
PROJECT MANAGER	C. FOULK	04/14/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 PRODUCTION
SITE INVESTIGATION

PROJECT LOCATION
BALLARD, HENRY, AND ENOCH VALLEY MINES

PROJECT
2009 SOIL AND VEGETATION CHARACTERIZATION

TITLE
ENOCH VALLEY MINE FACILITIES

MWH

FIGURE 3

REVISION B

FILE NAME 1005813D061

N:\Design-Drafting\Clients_I-P\Monsanto-P4 Production\1005813 2009 Soil and Vegetation Characterization\013-Sheet Set\1005813D061

ATTACHMENTS

This page was intentionally left blank.